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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/530,507

Applicant(s)

TIKKA ET AL.

Examiner

BARBARA SUMMONS

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Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 February 2008 (RCE & 1/28/08 amend.).
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 3-10, 12, 14, 15 and 17-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 12, 15 and 23-25 is/are allowed.
- 6) ☒ Claim(s) 3-10, 14, 17-22 and 26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-848)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection and received February 20, 2008. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's amendment after final as a submission filed on January 28, 2008 has been entered.

Withdrawn Allowable Subject Matter

2. The indicated allowability of claim 14 is withdrawn in view of the newly considered issues under 35 U.S.C. § 112. Previously the Examiner had considered the "LC resonator" of claim 14 to be the equivalent circuit of a bulk acoustic wave (BAW) resonator already recited, and as shown in Applicants' Figs. 1, 5a and 5b. However, it appears that Applicants may consider the LC resonator to be an alternative to the BAW resonator (see e.g. claim 8, lines 13-14 and the substitute spec. at page 12, lines 9-11), such an LC resonator being, e.g. the combination of a chip inductor and capacitor or a spiral inductor and parallel plate capacitor, etc. This possible meaning and structure leads to further new objections to the drawings for not showing claimed subject matter, and leads to unclear claims as indicated in the new objections and rejections that follow.

Drawings

3. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the filter or electrical

circuit (claims 8 and 14/15) wherein "the second resonator" (claim 14) or "the one of the resonators" (claim 8) "connected to the stacked crystal filter" (of claim 8) or connected to "the stack of resonators" (of claim 15), is "an LC resonator" as recited in similar language in claim 8 (see lines 11-14) and in claim 14/15 (see claim 15, lines 5-9 and 12-14) must be shown or the feature(s) canceled from the claim(s). Regarding claims 14 and 15, since the "second resonator" that is an "LC resonator" is also part of a "second stack of resonators" (see the last two lines of claim 15), such a second stack of resonators with one of the resonators being an LC resonator must also be shown. No LC resonators are shown in the figures per se, only the LC equivalent circuit of a bulk acoustic wave resonator is shown in the figures. No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner,

the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

4. Claim 8 is objected to because of the following informalities:

Claim 8 on lines 8-10 recites "each of the bulk acoustic wave resonators comprising: piezoelectric layers between the first electrode and the second electrode; and a third electrode among the piezoelectric layers" which is an incorrect statement since each resonator only has two electrodes and a piezoelectric layer and does not have a third electrode. It appears that Applicants are attempting to claim the layer structure of the stacked crystal filter which includes a third shared electrode between the two stacked bulk acoustic wave resonators (see e.g. third electrode E2 in applicants Fig. 10b).

Therefore, the Examiner suggests changing claim 8, lines 8-10 to:

- - resonators, [each] the stacked crystal filter arrangement of the two bulk acoustic wave resonators comprising:

piezoelectric layers between the first electrode and the second electrode;
and a third shared electrode among the piezoelectric layers; - -.

Appropriate correction is required.

Withdrawn Claim Rejections - 35 USC §§ 112 and 103

5. Applicants amendment and arguments received 1/28/08 as the submission of the RCE of 2/2008, have overcome all of the prior rejections and so they are withdrawn.

New Grounds of Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. § 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 3-10, 14, 17-22 and 26 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 14 recites that the second resonator comprises "an LC resonator", but claim 15 recites that the second resonator is contained in "a second stack of resonators" (see the last two lines thereof), wherein it is totally unclear how an LC resonator can be a part of a stack of resonators, or what structure is required of such a stack, when the only resonator stacks shown or discussed in the specification are stacked bulk acoustic wave resonators. Is the LC resonator only intended to be the equivalent circuit of the bulk acoustic wave resonator?

Claim 8 first recites that the filter comprises "resonators for use with bulk acoustic waves, each of the resonators comprising..." (emphasis added)[see claim 8, lines 1-2], but then recites that "one of the resonators" previously recited in lines 1-2, comprises "a bulk acoustic wave resonator or an inductive-capacitive (LC) resonator" (emphasis added)[see claim 8, lines 11-4], which renders the claim unclear as to whether each of the resonators is a bulk acoustic wave resonator or not, and unclear as to how an LC resonator is "for use with bulk acoustic waves". Claim 9, which recites that "the one of the resonators is an LC resonator", is unclear for the same reasons. New claim 26, which recites "the one resonator comprises at least one passive inductive component

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and at least one passive capacitive component", is also unclear for the same reasons. In the prior art rejections below, the Examiner is going to consider a bulk acoustic wave resonator to also be an LC resonator by way of its equivalent circuit such that "the one of the resonators" that is an LC resonator is considered to actually be a bulk acoustic wave resonator with an equivalent electrical circuit that is an LC resonator, since this is the only embodiment shown by Applicants in the figures. In other words, because there is no LC resonator of the chip type or spiral/meander inductor and parallel plate capacitor type shown, these are not considered to be compatible or are considered to conflict with the BAW resonators or the stacks of resonators recited in the claims in their current form.

New Grounds of Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claims 5, 7-9 and 26 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Hovgaard U.S. 1,959,429 in view of Metzger et al. U.S. 6,927,649 (of record).

Regarding claim 8, Figs. 1 and 2 of Hovgaard disclose a filter comprising piezoelectric crystal resonators (see line 82) inherently for use with bulk acoustic waves, by definition of such resonators, each of the resonators comprising: a lower layer region comprising a first/lower electrode 6, 7, 8 for resonators X,Y,Z, respectively; an upper layer region comprising a second/upper electrode 7, 8, 9 for resonators X,Y,Z; and a piezoelectric crystal layer therebetween; wherein two of the resonators X and Y are in a stacked crystal filter arrangement, the two resonators X and Y comprising bulk acoustic wave resonators, and the stacked crystal filter arrangement of the two resonators X and Y comprising: piezoelectric crystal layers between the first/lower electrode 6 and the second/upper electrode 8; and a third shared electrode 7 among the piezoelectric layers; wherein one of the resonators Z is connected to the stacked crystal filter arrangement X,Y so that a combination of the two resonators X,Y and the one resonator Z form an element of a ladder filter (see Fig. 2), the one of the resonators Z also comprising a BAW resonator. Regarding claims 9 and 26, as shown in Fig. 2, the BAW resonators are also LC resonators with a passive inductor and capacitor.

However, regarding claim 8, Hovgaard does not disclose a capacitor in series or in parallel with one of the two resonators X,Y in the stacked crystal filter arrangement, the capacitor being integrated as metal layers within a multilayer substrate, and does not disclose mounting its resonators on such a multilayer substrate with an air gap or an

acoustic mirror at the lower layer region between the multilayer substrate and the resonators.

Metzger et al. discloses that it would have been extremely well known to mount bulk acoustic wave resonators including stacked crystal filter arrangements and ladder filters (see col. 7, lines 16-25) on multilayer substrates MS (see Figs. 1 and 2) with either an air gap HR or acoustic mirror of alternating high acoustic impedance HZ and low acoustic impedance LZ layers providing acoustic isolation between the resonators and the multilayer substrate. Metzger et al. also discloses that it would have been well known to connect a capacitor either in parallel or series with individual resonators of a ladder filter and form the capacitor in the layers of the multilayer substrate MS (see e.g. col. 7, lines 41-46).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter of Hovgaard (Figs. 1-2) by having provided it on a multilayer substrate with either an air gap or acoustic mirror for acoustic isolation between the resonators and the multilayer substrate, and with a capacitor in the layers of the substrate and connected in series or parallel to one of the stacked resonators X,Y, because Hovgaard is silent as to the mounting of the resonators, thereby suggesting to one of ordinary skill that any well known mounting scheme such as the extremely well known multilayer substrate with air gap or acoustic mirror as explicitly suggested by the exemplary teaching thereof by Metzger (see Figs. 1 and 2), would have been usable therewith, and connecting a capacitor in series or parallel with one of the individual resonators of the stacked crystal filter X,Y and forming

the capacitor in the multilayer substrate layers would have been merely an extremely well known means of adjusting the filter properties as explicitly suggested by Metzger (see col. 7, lines 41-46).

10. Claims 3, 4, 6 and 17-21 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Hovgaard U.S. 1,959,429 in view of Metzger et al. U.S. 6,927,649 (of record) as applied to claims 8 and 5 above, and further in view of Klee et al. U.S. 2001/0048352 (of record).

The Hovgaard/Metzger combination discloses the invention as discussed above, except for both or at least one of the upper and lower layer regions including a plurality of layers of different materials, and regarding claims 6 and 20, one of the acoustic mirror layers comprising an electrode layer, and regarding claim 19, acoustic mirrors being provided both in the upper and lower layer regions.

Klee et al. discloses that it would have been extremely well known in the BAW resonator filter art to form the electrodes of multiple layers of different materials, e.g. Ti/Pt or Ti/Pt/Al or Ti/Ag, etc. (see e.g. section [0039]) and to have an acoustic mirror with one of the layers being an electrode layer (see section [0065], the last three lines thereof), and to provide acoustic mirrors both above as well as below the resonators (see section [0066]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the BAW filter of the Hovgaard/Metzger combination by having: (1) used multilayer electrodes; or (2) used multiple layer

acoustic mirrors with one of the layers providing the electrodes; or to (3) have provided an acoustic mirror in the upper layer region in addition to the one already provided in the lower layer region to be used as filter lids, because such obvious modifications as suggested by the exemplary teaching thereof by Klee et al. (sections [0039], [0065], last three lines, and [0066]), would have been: regarding (1) the mere substitution of art recognized alternative electrode structures wherein multilayer electrodes would have been extremely well known to provide the required density, mass loading, and acoustic velocity required for the resonators in each individual application, and furthermore Ti would have been a well known adhesion layer providing adhesion of the, e.g., Pt electrode layer to the piezoelectric layer; regarding (2) would have been merely the advantageous double-duty use of a layer of the acoustic mirror for the additional purpose of an electrode layer, providing the benefit of fewer manufacturing steps and a cheaper device since a distinct further electrode layer need not be formed; and regarding (3) an upper acoustic mirror in place of filter lids/covers would have been merely the substitution of an art recognized alternative packaging structure well known by one of ordinary skill in the art, as evidenced by Klee (section [0066]) for providing the necessary protection of such BAW resonators from environmental factors which must inherently be packaged in some manner for environmental protection.

Allowable Subject Matter

11. Claims 12, 15 and 23-25 are allowable over the prior art of record.

12. Claims 10 and 22 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Response to Arguments

13. Applicant's arguments with respect to the claims as previously rejected by the Nishimura, Tikka and Klee references have been considered but are moot in view of the new ground(s) of rejection.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to BARBARA SUMMONS whose telephone number is (571)272-1771. The examiner can normally be reached on M-Th, M-Fr.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bob Pascal can be reached on (571) 271-1769. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

bs
May 9, 2008

/Barbara Summons/
Primary Examiner, Art Unit 2817